Chemical & Engineering NEWS
November 9, 1981

Major solvents face no growth in 1982
A Key Chemicals Review Page 12

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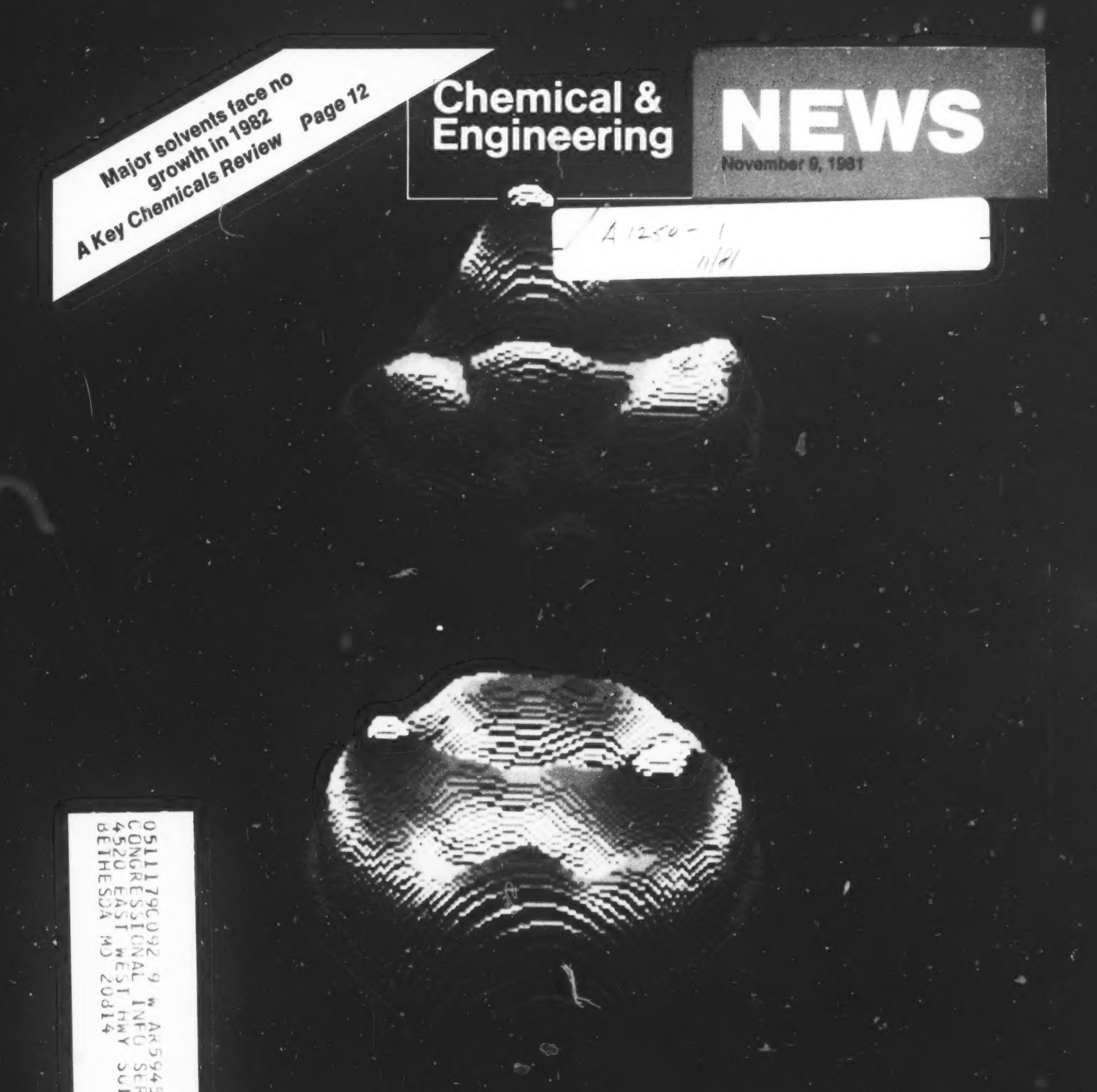

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Positron tomography

Advances in synthesizing radio-labeled compounds
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Cover: Positron tomographic images of glucose metabolism in brain sections of a schizophrenic male (top) and a normal male (bottom). The schizophrenic's eyes are open, leading to high metabolic activity in the occipital cortex (back of image). Large blue-green area in the frontal cortex (front of image) signifies the depressed metabolism characteristic of schizophrenics. Photo courtesy of Brookhaven National Laboratory/New York University PETT project.

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No recovery in sight for major solvents

Current economic downturn combines with rising imports to give acetone, ethanol, and methylene chloride a troubled outlook for 1982

As 1981 enters its surprise finale, another U.S. recession, producers of three important organic chemicals used largely as solvents—acetone, ethanol, and methylene chloride—will be closing their books on a no-recovery year. Unhappily, the books then will open on an equally unpromising 1982.

Solvents didn't have that much profits steam even before the last recession in 1980. They have less now and a pack of other troubles even without the current recession. Underlying market growth is spotty, and competition is beginning to hurt from alternative chemicals and foreign supplies.

The depressing result is that these three solvents probably will turn in a third straight, recession-level performance in 1982. Production volume will stay flat at a combined 4.0 billion lb, and total production value will remain stuck at $1.1 billion, the same as in 1980.

Actually, this value should be up more than 10% over the past year if producers are to recover their inflated costs. Admittedly, producers are finding ways to cut some production costs of most chemicals, and some raw materials price pressure has eased. But producers probably aren't cutting costs so much as inflation increases them.

The upshot for the next few years will be loss of new investment money for these solvents. Excess plant capacity is large for all of them, and all three have operated at less than 70% of nameplate capacity in 1981. This hurts income growth, since prices can't be increased and in fact are being widely discounted.

With low growth rates and, in the case of synthetic ethanol, competition from a brand new, nonpetroleum technology, several years will be needed even to reach existing capacity limits.

Ethanol is the most complicated and possibly gloomiest case of the three solvents. Some synthetic ethanol capacity might well be shut down later in the 1980's because of an upsurge in ethanol production from plants using grain-based, government-subsidized fermentation processes. Ethanol already has had a decade of plant shutdowns in the 1970's because of slipping demand.

The other two solvents also will have their peculiarities in coming years. Methylene chloride, one of the four chlorinated methanes, is made in the same plants producing the other three—methyl chloride, chloroform, and carbon tetrachloride. Changing the chlorine concentration permits wide changes in the product mix. Although no capacity seems likely to be shut down, the mix might shift radically in future years to more profitable products unless methylene chloride can recover its earlier growth promise.

Acetone's odd twist is its dependence on coproduct phenol production. In general, three quarters or more of acetone is produced via this route. When phenol demand falls off as it has this year, acetone production also must decline. Since the long-term outlook for phenol's dominant market in housing is getting less favorable, the longer-term outlook for phenol and, in turn, acetone production could be a holding pattern at best.

Still, acetone can't be driven into an artificial shortage even if phenol demand stays low. Considerable capacity for acetone exists in independent plants based on isopropyl alcohol. This capacity could take up any slack in acetone supply for some time. One possible difficulty in theory could be raw material propylene supply for isopropyl alcohol because of artificial market shortages caused by imbalances in multiproduct olefins plants.

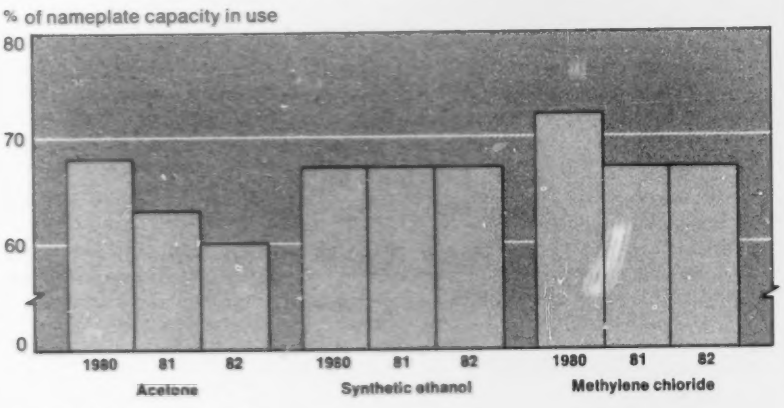
Longer term, the demand outlook for these solvents condemns them to slow growth, undoubtedly erratic as business cycles push these vulnerable products up and down. U.S. markets will have to absorb increased imports and declines in exports. The foreign trade flip-flop already has hit as costs of these products in the U.S. rise to meet or exceed worldwide averages.

Rising imports from regions with relatively less costly feedstocks also may have to be absorbed into U.S. markets. Such imports would tend to put downward pressure on U.S. prices, further hurting profitability and future investment. Imports, particularly ethanol made by fermentation processes, could lead to shutdown of U.S. capacity or at best conversion to other products.

For details on the immediate outlook for these solvents, see the following pages.

Bruce Greek, Houston

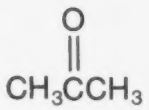
Plant use will stay very low for solvents in 1982



Sources: Industry, C&EN estimates

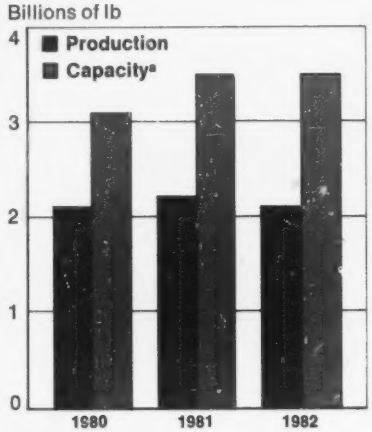
Key Chemicals

Acetone



- ***Demand off***
- ***Some capacity idled***
- ***Prices discounted***

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Coproduction with phenol by oxidation of cumene; dehydrogenation of isopropyl alcohol

MAJOR DERIVATIVES (U.S.)

Methyl and other methacrylates 30%, methyl isobutyl ketone 10%

MAJOR END USES (U.S.)

Solvents, alone or as derivatives, 60%; fabricated plastics 30%

FOREIGN TRADE

Exports—declining to about 175 million lb in 1981, imports—negligible

PRICES

Below-list price 29 cents per lb

COMMERCIAL VALUE

$600 million for 1981 production

The U.S. acetone business will tilt downhill next year, swerved from recovery by a weak U.S. market and falling exports. It won't make much difference that demand also is down for acetone's coproduct, phenol, which controls acetone output. Spare acetone is always available from independent isopropyl alcohol-based plants.

In 1980, roughly 80% of 2.2 billion lb of acetone produced in the U.S. came as coproduct with phenol made from cumene. The remainder came from dehydrogenation of isopropyl alcohol, by far the older of the two processes used to make acetone.

With a renewed U.S. recession now apparently under way, hurting housing starts and commercial construction, demand for phenol in this important market will slide during the rest of 1981 and at least through some of 1982, probably until midyear. As a result, acetone production likely will drop to perhaps 2.1 billion lb in 1982. This will follow a slight upturn in 1981 production but will put acetone volume right back where it was in 1980.

Hence, three essentially flat production years will leave acetone swimming in extra plant capacity, even though capacity currently is overstated. Of the total 3.5 billion lb per year of nameplate capacity, about 250 million lb has been shut down for periods between two months and more than a year. This shutdown estimate could be low in view of the slow demand for phenol. Another 100 million lb of capacity might be down as well, bringing the shutdown figure to 10% of the total.

On a nameplate basis, 1981 production of acetone will result in an operating rate of only 60%, not very profitable. Owing to the confirmed or rumored capacity shutdowns, the operating rate at plants actually running more realistically will be about 70%.

Just over a third of total acetone capacity now is based on isopropyl alcohol. Yet only about 20% of production comes from this source. This share may be rising, however, because of depressed demand for phenol, which lowers the operating rate for cumene-based plants. Nevertheless, the fraction of acetone from isopropyl alcohol still won't reach the nominal one-third share of capacity during 1982.

Prospects for renewed growth in acetone demand in 1981 and 1982 are not good. The U.S. market will have to absorb a reduction in exports in 1981 of about 75 million lb. Although this decline in exports accounts for only 3.5% of production, it could more than equal demand growth this year. A further decline in exports during 1982 is expected by some industry sources, meaning that even more acetone would have to go into U.S. markets.

If the recession continues well into 1982, U.S. demand might not expand enough to absorb the export loss. The result will be lower production quite apart from the influence of lower demand for phenol. Because production of acetone from isopropyl alcohol is considered the "swing" source, this acetone flow will rise or fall to handle the net demand change.

The use pattern for acetone will change little over the next year or so. The larger uses in solvents and manufacture of methacrylates look flat for a year or so because of the recession. Changes in air pollution control regulations hurting other solvents might help acetone a bit eventually, but for now a more important influence is the state of the business cycle.

In methacrylates, growth has slowed from more than 10% a year during the 1970's to an estimated 3 to 5% annually later in the 1980's. These resin materials will continue to be the largest single use of acetone but no longer will be the rising star of the use pattern. The methacrylate markets other than methyl methacrylate are relatively small and all told may account for only 15% of the use of acetone in methacrylates.

Of all acetone uses, bisphenol A is expected to continue to have the best growth rate, possibly more than 6% annually for the 1980's. This product, formed by reaction of acetone and phenol, goes mainly into epoxy and polycarbonate resins. Other bisphenol A uses are small-volume specialty resins. Producers of bisphenol A also make the two raw materials, providing some higher-value captive use for both to help improve profitability.

On balance, for the rest of 1981 and well into 1982, acetone producers hope simply to hold their current production level and then await better times.

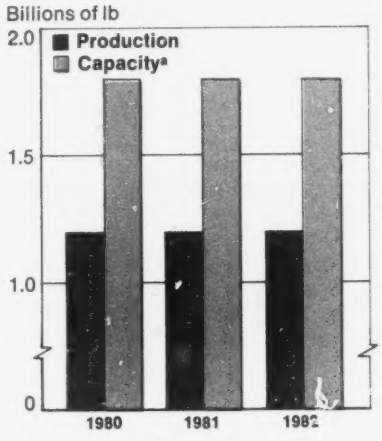
Key Chemicals

CH_3CH_2OH

Ethanol

- ***Demand flat***
- ***Capacity excessive***
- ***Prices soft***

PRODUCTION/CAPACITY



[a] Synthetic only as of first quarter.

HOW MADE

Synthetic—hydration of ethylene

MAJOR DERIVATIVES (U.S.)

Esters 10%, amines 5%, ethers 5%

MAJOR END USES (U.S.)

Solvents 55% (80% including derivatives), food 10%

FOREIGN TRADE

Exports—holding around 60 million lb; imports—rising, may reach 350 million lb, including fermentation ethanol used industrially

PRICES

List prices, between $1.90 and $2.10 per gal

COMMERCIAL VALUE

$350 million for 1981 production

If it's raining on the economic outlook for acetone, it's pouring on ethanol. In fact, it's hard to imagine what more could go wrong.

Most U.S. producers of synthetic ethanol based on petroleum expect three consecutive years from 1980 through 1982 of flat production at about 1.2 billion lb, or a bit more than 180 million gal, the standard industry measure.

It might take beyond 1983 for production to again exceed 1.4 billion lb or 210 million gal, the 1979 level.

This output plateau in synthetic ethanol follows a long-slumping decade after the peak of 2.3 billion lb, or 348 million gal, in 1969. This long-term decline has brought plant shutdowns, and current nameplate capacity of about 1.8 billion lb per year, or 270 million gal, is well below the former peak production level.

At the moment, about a third of this synthetic ethanol capacity isn't needed. None is expected to be shut down in 1982, but later shutdowns might dot the 1980's as in the 1970's.

If this weren't enough, synthetic ethanol producers must now contend with fallout from U.S. production and imports of fermentation-process ethanol based on grain. Government-subsidized and now lower-cost, fermentation ethanol slowly has eased its way into long-held markets of synthetic ethanol even though the market originally intended for the fermentation product was gasohol in the unrelated fuel business.

Plant capacity for fermentation ethanol continues to rise in many parts of the world. However, many targeted fuel markets are proving a disappointment. In some countries, subsidies are the spur to this construction. In others, the incentive is improved technical efficiency combined with very low-cost raw materials.

In the U.S., fermentation ethanol, either domestically produced or imported, is increasing its newfound share of "industrial" markets for petroleum-based ethanol. These markets are defined as those other than fuels (gasohol) and beverages. Many of these uses are in the lower-grade areas for solvents. These contrast with higher-quality outlets such as cosmetics, in which customers are very concerned about ethanol purity. Here, synthetic ethanol still generally gets the nod.

Ethanol's two-tier uses and sources easily can throw confusion into ethanol statistics, even official government production data. For example, most industry sources put 1980 synthetic ethanol production at 1.2 billion lb, roughly the same as the preliminary estimate of the government's International Trade Commission. However, the final ITC production number is higher by some 200 million lb. Industry analysts believe the new figure has errors that developed during ITC's efforts to get hard reports of all ethanol production and thereby eliminate estimates used in preliminary numbers.

Similarly, ethanol consumption data in industrial uses have become less clear because of a blurring of ethanol sources. In 1981, ethanol use in industrial markets, excluding fuels and beverages, is expected to total 200 million gal, possibly 205 million gal, or 1.3 billion to 1.35 billion lb. Of this, synthetic ethanol will supply about 170 million gal, or 1.1 billion lb. The rest of U.S. synthetic ethanol production, 10 million gal or so, will be exported. Imports, mainly fermentation ethanol, and domestically produced fermentation ethanol will supply the rest of U.S. demand, 30 million to 35 million gal.

Much incentive exists for such sale of fermentation alcohol to industrial uses: the large increase in plant capacity for fermentation alcohol, a slump in demand for alternate fuels usage, and lower cost compared to synthetic ethanol as long as raw material corn prices remain relatively low.

This overhang of fermentation ethanol on the industrial market continues to undermine real selling price for synthetic ethanol. In general, analysts estimate that fermentation ethanol is about 20 cents a gal cheaper for many solvent uses compared to the list price for synthetic ethanol. Therefore, especially in spot sales, synthetic ethanol producers are not always getting their list price.

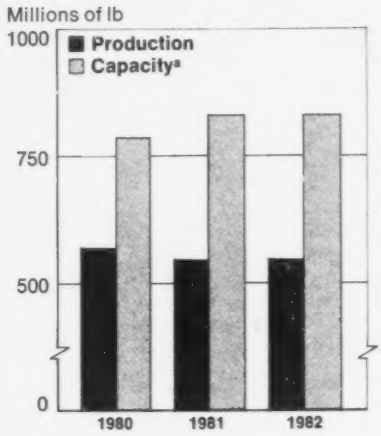
Thus with the prospect of a U.S. recession, no real growth in most uses, rising imports and U.S. production of fermentation ethanol, and rising costs of ethylene, synthetic ethanol producers expect no better in 1982 than they got in 1981.

CH_2Cl_2

Methylene chloride

- ***Demand low***
- ***Capacity high***
- ***Prices under pressure***

PRODUCTION/CAPACITY



a First quarter, varies with product mix.

HOW MADE

Chlorination of methane; hydrochlorination of methanol, then chlorination of methyl chloride

MAJOR DERIVATIVES

None of any size

MAJOR END USES

Paint remover 30%, aerosol propellants 20%, degreaser 10%

FOREIGN TRADE

Exports—dropping sharply to about 30 million lb in 1981, imports—up to some 60 million lb in 1981

PRICES

List price 30.5 cents per lb

COMMERCIAL VALUE

$160 million for 1981 production

U.S. producers of chlorinated methanes hope the rest of these products will have a better year coming up than will methylene chloride. Companies might wish that methylene chloride output in 1981 and 1982 will match 1980, but that probably won't happen. Production likely will be off a bit each year, and some plant capacity for methylene chloride will be shifted to more profitable products.

In 1981, production could total 550 million lb, down from about 560 million lb in 1980. For 1982, some producers forecast the same level as in 1981 but without much conviction. A more likely total for 1982 will be 525 million to 540 million lb.

Plant capacity at this production rate certainly will not be strained. A rough estimate of total U.S. methylene chloride capacity is 825 million lb a year. However, depending on the producer, capacity is quite variable.

Some producers may be able to shift production by 25% of nameplate capacity either way, depending on the market situation. Hence, actual total capacity may range between 600 million lb and 1 billion lb with different product mixes.

A major reason for small declines in methylene chloride output in 1981 and 1982 is an import surge starting about mid-1981. Such imports, rumored being sold at discounts of 10% or so off U.S. list prices, are expected to continue coming in over the rest of 1981 and 1982.

At the same time, methylene chloride exports are declining, adding another reason for a decline in U.S. production. The new strength of the U.S. dollar is tending to hurt exports of all U.S. products, and methylene chloride is no exception.

Domestically, only small changes are occurring in this solvent's use pattern. Volume is holding up in its largest use as an ingredient of paint remover. Demand here is subject to some impact from inventory shifts in the finished product. This happens because much paint remover is sold under small-volume private labels. This results in middleman distributors of methylene chloride being important in the paint remover market. Many of the small formulators make paint removers only intermittently during the year and need a periodic supply source.

Paint remover containing methylene chloride goes into both industrial and consumer markets. In both, its advantages of high solvency, relatively low toxicity, and exemption from many restrictions in air pollution control rules help to spur growth. Offsetting these pluses currently is the U.S. recession, which reduces most industrial operations and discretionary consumer spending by do-it-yourself furniture refinishers. Because of the natural lag between eventual upswings in retail sales and in chemical production, growth in this application of methylene chloride probably will be small until 1982.

Next in size among uses of methylene chloride is the aerosol propellant outlet. Growth in this outlet has been good because of the shift away from rival chlorofluorocarbons. However, growth in this "capture" market, in response to chlorofluorocarbons' suspected damage to atmospheric ozone, is shrinking rapidly. The rate is still good, but in a year or so it may level off, tied after that to overall growth in aerosol products.

In another "capture" market, methylene chloride also replaces trichloroethylene as a metal degreasing agent. Here, too, much of this change already has taken place. Growth in this application is expected to be small from now on.

For the same reason that it is used in paint removers, methylene chloride finds use as a blowing agent for making polyurethane foams. In the past this use has had good growth, but this year the rate has fallen off with the decline in housing, an important market. After a lag to allow inventory changes, this use would pick up with any recovery in housing.

Many other uses of methylene chloride also hinge on its solvency properties. None of these are large enough to have a big impact on its total consumption.

Methylene chloride's many separate markets combine to give it a weak outlook until probably after 1982. Then this chemical might recover some of its old promise and get back on the track of overtaking carbon tetrachloride as the largest-volume chlorinated methane.

Brazil targets more ethanol for chemicals

To help country fulfill goal, Oxiteno and U.S.'s Halcon SD Group plan joint R&D effort to develop new routes to ethanol-derived chemicals

There is, as the old song says, an awful lot of coffee in Brazil.

What the song doesn't mention is that there also is an awful lot of sugar, much of which is being converted into ethanol under the country's heralded alcohol fuels program, or PROALCOOL, as it's called in Brazil.

Despite some recent setbacks—the country's stumbling economy has cut back on production of all cars, including those designed to run exclusively on alcohol, and the all-alcohol car has run into more than its share of operating problems—Brazil is pushing ahead toward its goal of producing 10.7 billion L per year of ethanol by 1985. Output will be about 4 billion L this year.

If Brazil even comes close to reaching its 10.7 billion L goal by 1985, its already substantial ethanol-based chemical industry probably will have about 1.5 billion L, or about 400 million gal, of ethanol to use as a chemical feedstock.

For Brazil's chemical industry, the PROALCOOL program is important in more ways than one. Not only will increasing volumes of ethanol become available to use directly as a raw material for a wide range of chemicals, but the large volumes of ethanol earmarked for fuel will free a lot of additional naphtha for Brazil's petrochemical complexes. Meanwhile, basing at least part of its chemical output on ethanol will enable the country to fulfill another of its high-priority objectives—to decentralize production and establish new industries in poor, less-developed regions of the country.

Brazil, then, has a lot riding on an expanded alcohol-based chemical industry. So does Oxiteno S.A. (São Paulo) and the Halcon SD Group. Oxiteno, Brazil's largest privately held chemical company, and Halcon SD recently signed an agreement for a joint program of research and development that will concentrate on developing existing and new processes using ethanol as feedstock. Oxiteno will do most of the work under the five-year program at its pilot plant facilities in São Paulo. Halcon SD will support the program with its own laboratory work in the U.S.

Halcon SD and Oxiteno are no strangers. Halcon SD already has a 10% equity interest in Oxiteno. And Halcon SD technology is being used at two Oxiteno plants in Brazil to produce ethylene oxide, ethylene glycol, and other ethylene oxide derivatives.

As Halcon SD president and chief executive officer Robert Malpas explains it, the joint R&D effort will concentrate on developing new routes to make ethanol-derived chemicals. "Most of these chemicals already are in the textbooks," he says. "We want to develop new, more economical methods of producing them."

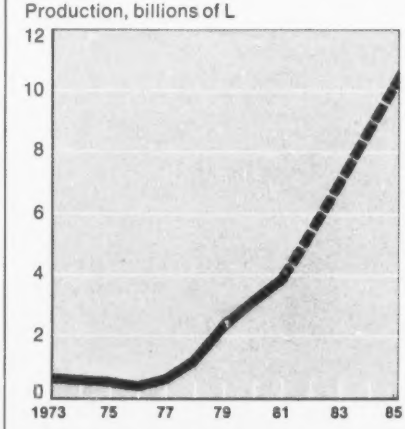
New technology that comes out of the joint R&D program will be patented in the names of both parties. Initially, Oxiteno will use this technology in Brazil. It also has exclusive rights to license it to third parties in Brazil.

Halcon SD gets to use the technology in plants that it or its affiliates own or operate as well as third-party licensing rights in all areas of the world outside Brazil. The most promising areas, says Malpas, probably will be oil-poor but biomass-rich countries in Latin America, Asia, and Africa.

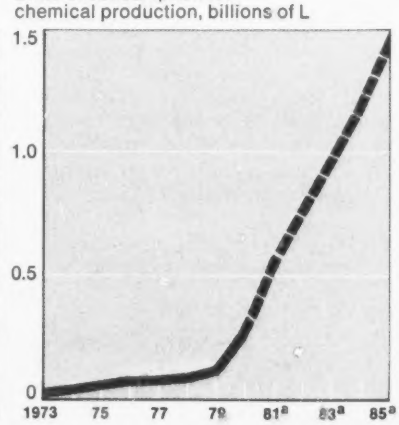
Abichara: technology will be developed

Araguarayno Abichara, director of Oxiteno, thinks that programs such as the joint Oxiteno-Halcon effort are important, not only for his company, but for all of Brazil. It's one thing to plan on having 1.5 billion L of ethanol

Brazil's ethanol output is big and getting bigger...



...with more slated for chemicals



a Petrobras estimates. **Source:** Petroquisa

available for chemical production in 1985, with prospects of even much greater volumes in the next decade. But it also is necessary, he says, to be able to use this raw material economically. That, says Abichara, is why it is important to start now to develop the technology that will make ethanol-derived chemicals competitive with petrochemicals.

Right now, most of them aren't. This year, Brazil will use an estimated 600 million L, or about 160 million gal, of ethanol to produce a wide variety of chemicals, including ethylene, acetaldehyde, octanol, and butanol. With the possible exception of acetaldehyde, none of these ethanol-derived products are competitive with their petrochemical counterparts without a subsidy provided by the Brazilian government.

Abichara is confident that technology will be developed to make these ethanol-based chemicals competitive. But Oxiteno isn't waiting for that technology to be tied up in a neat package. In Alagoas state in northeastern Brazil it already is building plants to produce 55,000 metric tons per year of acetaldehyde, 14,000 metric tons per year of acetic acid, 30,000 metric tons of butanol, and 10,000 metric tons of butyl acetate. All are based on ethanol.

Oxiteno's plants in Alagoas will help foster Brazil's plan to use the PROALCOOL program to divert chemical production away from existing petrochemical complexes. Salgema Industrias Quimicas, a subsidiary of Petrobras, the state-owned oil company, already is operating a 60,000 metric-ton-per-year ethylene-from-ethanol plant at Maceio in the state of Alagoas. The Salgema plant is part of a complex that includes chlorine, caustic, and ethylene dichloride.

Meanwhile, in Pernambuco state just to the north of Alagoas, two other ethanol-based chemical projects are shaping up. Coperbo has a plant at this site to produce butadiene from ethanol, but it is being converted to ethylene and acetaldehyde. The company also is planning to produce vinyl acetate (from the ethylene) and acetic acid.

Elekeiroz Nordeste already produces butanol and octanol from ethanol in Pernambuco. These units are being expanded.

Plants such as these, based on ethanol, never will replace Brazil's huge petrochemical complexes. But they will play an important role in the country's overall chemical industry.

Earl Anderson, New York

Tough decade ahead for aromatics

Outlook for the aromatics business in the 1980's is "somber," according to BP Chemicals' Michael H. T. Janes. "It will be a tough decade, with low [plant] utilization rates in all but the occasional boom year," he believes. "I am predicting a pessimistic situation in world demand, with the likelihood that growth in markets will not match what we saw in the 1970's," he says.

Janes, who is purchasing manager at his company's headquarters in London, presented his thoughts on the subject at the European Chemical Market Research Association's annual conference, which this year was held in Cannes, France. "If you're losing your shirt today, hang onto your pants tomorrow," he quipped.

A number of pitfalls lie ahead. "Markets will be unstable and face competition from producers willing for various reasons to accept unremunerative prices. Feedstock costs may be reasonably stable up to mid-decade, but that is far from guaranteed. This will represent some change for the U.S., which has enjoyed relative prosperity over the period of crude-oil regulation, assisted, at least up to 1979, by high-octane demand for toluene and xylenes. For Western Europe and Japan, however, these problems will not be new or different from what we have experienced since 1974."

Demand will depend largely on the level of economic growth in the years to come. "It is a feature of the industry that when gross domestic product sneezes, aromatics catch a cold," Janes observes. "Plant utilization rates will be very low if there is a setback to future growth in GDP, an outcome that would impose severe problems for the industry, and call for substantial retirement of older capacity." In addition, there is the disruption that will stem from emergence of new producing countries, mainly Mexico and Saudi Arabia, and new plants planned for Western Canada.

Looking at the GDP growth prospects for the 24 industrialized countries that make up the Organization for Economic Cooperation & Development (OECD), "my conclusion is that the best outcome at 3% per year average will be below the [3.2% per year] average achieved in the 1970's," Janes says. "But there is a real prospect of a serious decline in world economic growth, even to an average rate as low as 1.5% per year.

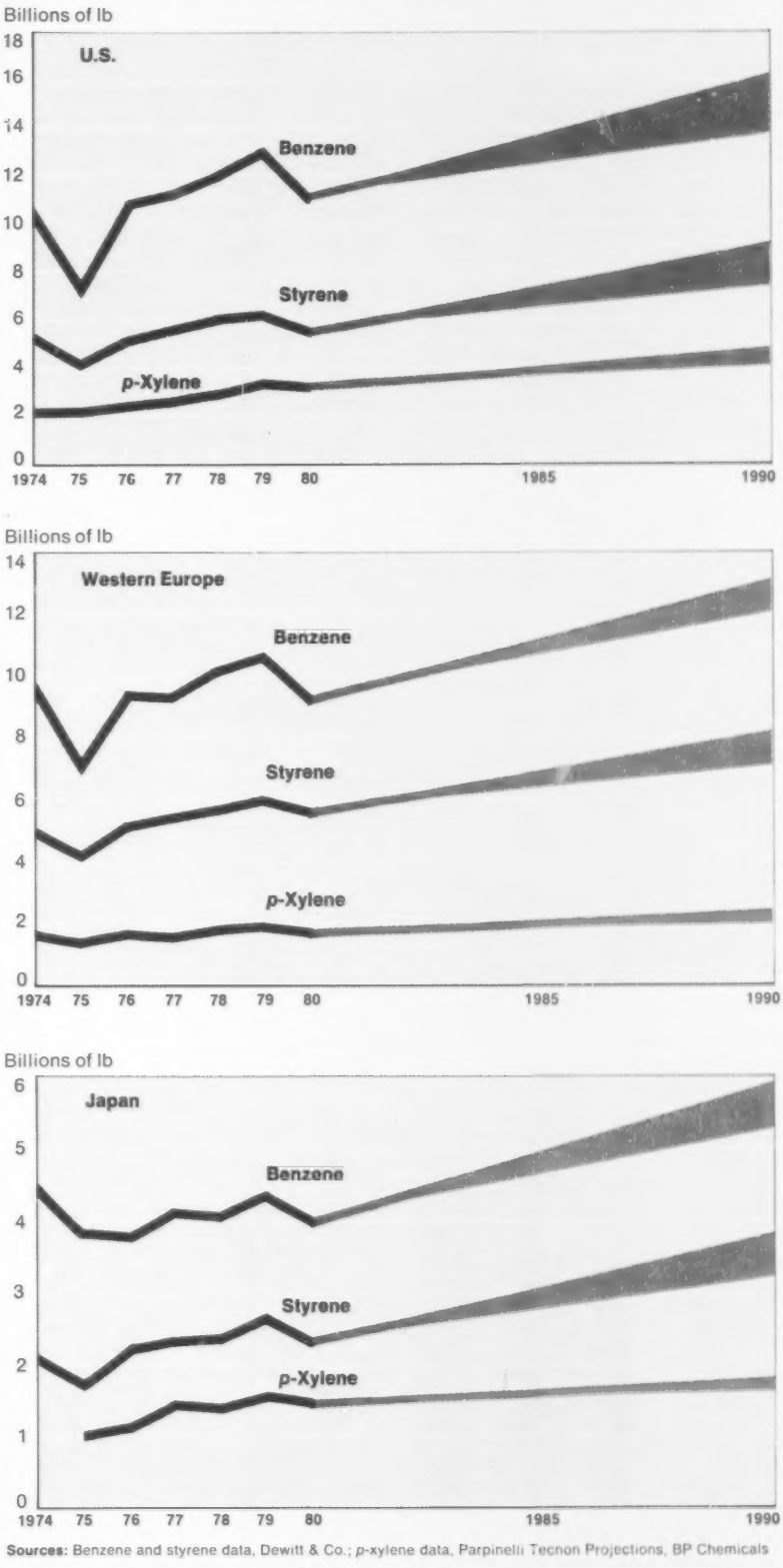
"The actual out-turn is going to be of the utmost importance to aromatics producers in the industrialized regions of the world. The aromatics industry is faced with an unstable and a cyclical demand pattern. I think that the 1980's will exhibit more, rather than less, instability than the 1970's, particularly if overall economic growth comes out at the lower end of the span. Low growth means larger interruptions, and larger cyclical savings in demand. This cyclical instability presents the forecaster with almost insuperable problems, because our normal measure, the annual average growth rate, can scarcely do justice to large deviations from the trend."

For the U.S., GDP growth might range between a per-year average of 1.25 to 2.25%. This would be slightly below Western Europe's expected annual average range of 1.5 to 3%. Growth in Japan, on the other hand, likely will average a stronger 3.5 to 5% per year. With such a range of growth rates in view, Janes looks at the possible trends in consumption of benzene, styrene, and *p*-xylene in the various geographic regions, consumption being local production and imports minus exports.

In the U.S., growth of these aromatics could outpace that of GDP. For instance, if, as Janes thinks, benzene demand rises at an average yearly rate of 1.5 to 3%, the 1990 total will lie between a low of 14 billion and a high of 16.2 billion lb. If styrene demand grows 2.5 to 4.5% annually, 1990 consumption will range from 7.7 billion to 9.3 billion lb. "Styrene growth is particularly dependent on some revival of the U.S. auto industry using more plastic components per vehicle to improve mileage performance," he remarks. *p*-Xylene, benefiting from a relatively stronger U.S. domestic synthetic fiber industry, might expand 2 to 3.5% per year, raising 1990 consumption to 4.1 billion to 4.8 billion lb.

Throughout Western Europe, Janes sees a benzene demand growth trend of 2 to 3% per year, much in line with that of GDP, to a 1990 total of 12.2 billion to 13.4 billion lb. Styrene could be slightly ahead of GDP at an annual average of 2 to 3.5%, and a 1990 consumption of 7.1 billion to 8.2 billion lb. Western Europe's *p*-xylene outlook is poor, however, both because of the weak state of the synthetic fiber industry there, and weak exports of fiber intermediates. He selects a likely growth of 0.5 to 2.5%

Consumption of aromatics in U.S., Western Europe, and Japan is forecast to grow steadily despite problems



Sources: Benzene and styrene data, Dewitt & Co.; *p*-xylene data, Parpinelli Tecnon Projections, BP Chemicals

annually, with a 1990 consumption of 1.9 billion to 2.3 billion lb.

"For similar reasons," Janes adds, "demand growth both for cyclohexane, and nylon from phenol, are held to be little above zero at best, and negative at worst. *o*-Xylene demand, which looms much larger in the spectrum of aromatic products in Western Europe than elsewhere, is vulnerable to loss of export markets downstream from the mid-1980's, but may keep pace with GDP over the decade as a whole."

Growth of Japan's aromatics consumption hardly will match the expected substantially higher GDP pattern there. For instance, Janes sees benzene's annual growth ranging from 2 to 3.5%, with a 1990 total of 5.2 billion to almost 6 billion lb. "This disparity reflects Japan's relative lack of indigenous energy resources."

Styrene consumption growth in Japan might match that of the U.S.'s 2.5 to 4.5% per year, although in terms of quantity the 1990 total would be much less, somewhere between 3.2 billion and 3.9 billion lb. *p*-Xylene growth is seen moving at a sluggish 0.5- to 1.5%-per-year rate to 1.6 billion to 1.8 billion lb in 1990. *p*-Xylene, and also cyclohexane, demand in Japan "is particularly dependent on derivative exports to developing countries, which are regarded as vulnerable," according to Janes.

There is little doubt that if all the new aromatics facilities being considered by developing countries come to fruition, their output will have a decidedly adverse effect on established producers. Citing projections made by the United Nations Industrial Development Organization earlier this year, Janes notes that about 7 billion lb of benzene capacity might be expected in 1984, almost double the 1979 level. The increase would be even greater for the xylene isomers, with capacity moving up 1.5 times from the 1979 total to 4.7 billion lb in 1984. The plants will be spread throughout Asia, Latin America, the Middle East, North Africa, and China, with African and Middle Eastern countries appearing as new producers.

"Some of the new capacities will be in countries where overseas indebtedness is the main constraint on economic development," Janes says, "and there are inducements from governments or state-owned feedstock suppliers to operate near capacity for the sake of exports, or import savings, regardless of returns. The consequent pressure on the BTX [benzene, toluene, and xylenes] mar-

kets of the industrialized regions will be felt particularly by the dealkylators, and we must expect some capacity to be put on permanent standby. Utilization rates may be somewhat improved in Western Europe if naphtha cracking capacity is retired there, taking some associated extraction capacity with it."

Eastern Europe also looms large as a future source of aromatics. "Projects not matched by growth in [local] consuming capacity imply an additional 1.1 billion lb of net benzene exports by 1985," Janes notes. He admits to uncertainties of investment planning and plant construction schedules, which will diminish this figure substantially. "But we should allow for at least a doubling of 1980's 220 million lb net exports of benzene from Eastern Europe, bearing in mind that certain compensation deals will be honored," he reasons.

As for the ortho and para isomers of xylene, two large projects in the U.S.S.R. scheduled for startup next year will have combined capacity exceeding 660 million lb of each isomer annually. "The bulk of this capacity doubtless will be committed domestically, but some tonnage is committed under compensation to users in Western Europe," Janes says.

"The new competition is going to be an additional destabilizing influence as traditional importing countries emerge as exporters," Janes fears. This destabilizing influence will be more acute if world economic growth is at a low level.

"Utilization rates [of existing plants] in the industrial regions are going to be seriously depressed by imports of BTX and of derivatives. But I am not convinced that this will be too disastrous for aromatics profitability in Europe or Japan. Imports of benzene may be a preferred alternative to operating higher-cost hydrodealkylation units. And imports of low-priced toluene and xylenes may be preferred to reforming additional naphtha, especially for areas that depend on imported crude, and possibly face refinery imbalances and shortage of the light end of the barrel."

Janes see the xylene isomers "giving reasonable returns on historical capital in most years through the 1980's. There is considerable scope for further market penetration by polyester fibers in the populous countries of the Far East, particularly China. Some additional impetus should derive from higher growth rates expected for polyester film and resins still in the stage of market development. World demand for *p*-xylene should continue to grow at around 4 to 5.5% per year on average up to 1985, thereby creating the headroom for the new capacities."

By his own admission, Janes is less gloomy about the outlook for the xylene isomers in the 1980's than he is about styrene, which consumes about half the global benzene output. "Profits on styrene are more sensitive to utilization rates, and producers are more concerned about their share of the merchant market. The temptation to defend or extend that share by aggressive price tactics when utilization rates are low is very powerful. Whereas BTX prices remain fairly resilient to low market demand through reduced production by hydrodealkylation and through intermanufacturer purchases, styrene prices may erode at the very point where each unit of output has to bear a higher overhead cost as producers strive to maintain plant loadings.

"Looking further ahead, styrene producers must remain concerned about market disruption from competitors with an inside track on raw materials. New producing areas, such as Mexico, Western Canada, and the Middle East, are not content to be simply producers of low added-value aromatics. To the extent that they have ethane, which they wish to ship to the world's markets, they want to add an ethylene component."

As might be the case with the primary BTX aromatics, Janes isn't confident about the prospects of responsible marketing policies being followed by these new producers, even where large international oil companies have a participation. "It seems to be the clear intention of many host governments to use low feedstock values as an instrument of market penetration on the pretext that this is needed to compensate for higher costs of plant construction as compared, say, to the U.S. Gulf Coast. But to make total costs per unit of output level on this basis would mean introducing substantial differences in incremental costs on a product like styrene.

"There is, perhaps, a small crumb of comfort," Janes says. "If styrene is to be used as a vehicle for shipping ethane to the world's markets, in any given situation preference would be given to polyethylene or ethylene glycol over styrene, whose large aromatic content quite easily can earn world prices by being shipped as naphtha." □

Stronger role for U.S. chemical firms in Europe

"We have no doubt that involvement of U.S. chemical companies will continue in Europe, and, in fact, expand from present levels. There is good potential for growth in Europe."

Such is the contention of Richard F. Bechtold, Dow Chemical Europe's regional and planning executive vice president. He shared his views with participants in the European Chemical Market Research Association's meeting in Cannes, France. The positive stance he takes on the role of U.S. chemical companies in Europe in the years immediately ahead is all the more refreshing in light of Europe's depressing economic climate, and the severe overcapacity in many parts of its petrochemical industry.

C&EN staff photo

Bechtold: future is in specialties

Bechtold is convinced that the "flexibility" that characterizes American companies will serve as a spur to local West European producers to develop even more efficient and integrated manufacturing operations. The influence isn't one-sided, he is quick to note. He points to "the positive catalytic effect which European companies have exerted on the U.S. marketplace due to their presence in North America."

He holds that those U.S. chemical companies that are still strongly competitive in Western Europe in 1990 will have, with few exceptions, some common characteristics. "One of these characteristics will be the approach to Europe as a unified market to be served from within.